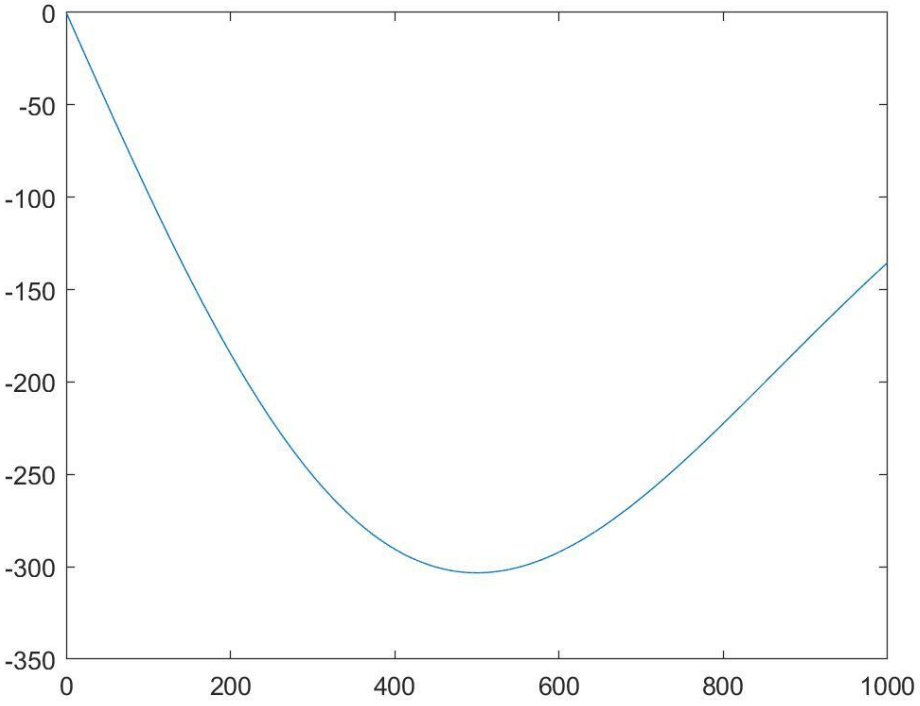
Principles

- Every agent possesses a capital.
  Such as social status, academic achievements, art works and others that can be accumulated.
- For friends: The more he has, the less he will lose.
  For foes: The more he has, the more he will lose.
  Capitals will gradually decay if agents stop making efforts.
  Decay function like:

$$D(s_t) = -B \cdot s_t e^{\frac{-s_t^2}{2\bar{s}_t^2}}$$

  where s_t denotes social capital of some agent, and B measures whether there is fierce competition in this field, if so, the spontaneous decay will be more dramatic.
  And this function in x>0 area is:



Decay function will reach its bottom at $\frac{\bar{s}}{\sqrt{e}}$. In the first part before reaching the bottom, the more capital the agent accumulates, the faster the decay rate will be. Because the group that already has completed the original accumulation will try harder to repel agents trying to enter their field. However, after reaching the bottom, things are gonna change. These agents are now accepted by the group and become their co-conspirators.

- Capital fallout leads to power. The dominant agents will take more.

  Denoting this mechanism using an allocating function:

$$AL(s_i) = C \cdot \sum_{j=1}^{N} \tanh\left[\frac{(s_i + s_j)}{2}\right] \cdot \frac{s_i}{s_i + s_j}$$

  where C is another global parameter, denoting to what extent the field is promising. For every cooperation, powerful agents will take more outcomes (as the fraction suggests), which manifests dominating relationships led by social capitals.

Scenarios

To verify the hypotheses, we deploy the model on three kinds of networks corresponding to three different conditions.

❖ Uniform random network——Free competition

We initialize capital as random value in (0, 1] so there is no capital monopoly at first.

❖ Scale free network——Oligarchy

We initialize the top 5% highest degree agents' capital as value in (99, 100], while the other mediocre in (0, 1] to simulate the dominance of oligarchs over other agents.

❖ Star network——Totalitarianism

We initialize the tyrant's capital as value in (99, 100] and other agents with initial capital falling into (0, 1] have to connect with the tyrant.

To generate the star network, first we have a random network with a designated average degree and make agents not connecting with the tyrant establish a connection.

Mechanisms

We have a constant network denoting agents' relationships. But the cooperation is up to some probability.

➢ Activate agents according to social capital.

The more one gets, the more he tends to have more chances to create and accumulate social capital (Matthew effect).

➢ Select partners.

Agents possessing similar capital tend to cooperate (like social exclusion).

➢ Unexpected expertise or serendipity

Select some agents other than oligarchs and tyrant randomly and confer a mean capital (also excluding oligarchs and the tyrant) on them.

Probable results

★ In the field of free competition, tycoons will emerge. Social capital distribution may be power law like.

★ Oligarchs can maintain their dominance.

★ Tyrant's reign will collapse.

Empirical Verification

➔ Free competition

➔ Oligarchy

➔ Totalitarianism
Such as conflicts between royal academy and impressionists in the 19th century.